



Armed Forces College of Medicine AFCM



Development of GIT 3

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INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. Describe the steps of development of midgut, including its components, the results of its herniation & rotation, peritoneal coverings.

Lecture Plan



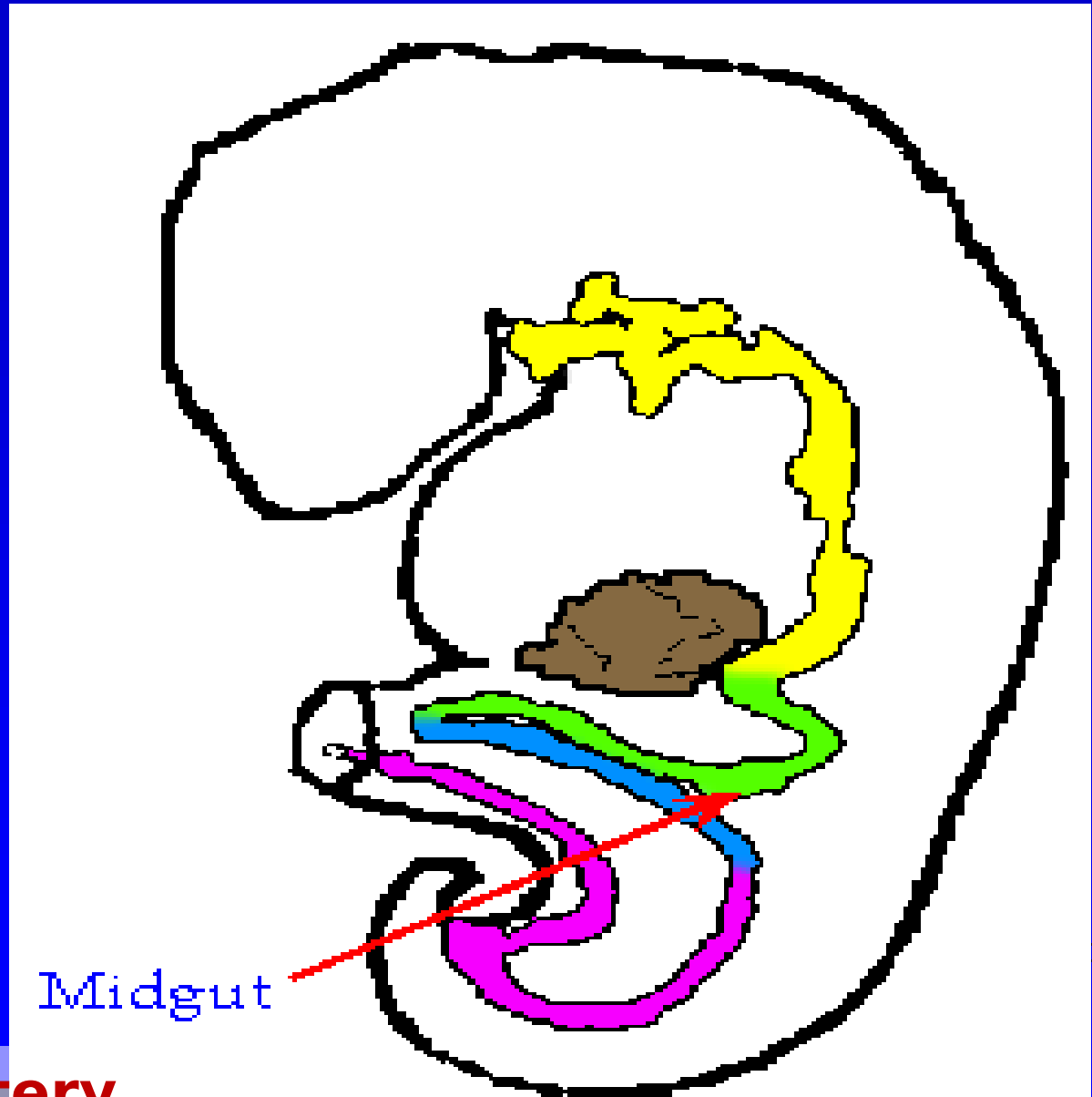
1. Part 1 (10 min) Introduction to midgut
2. Part 2 (20 min) steps of development of midgut
3. Part 3 (20 min) Anomalies of midgut
4. Summary (5 min)

Midgut

Development of the Midgut

- Midgut gives rise to:
 - Caudal part of duodenum
 - rest of small intestine
 - appendix
 - cecum
 - ascending colon
 - 2/3rds of transverse colon

Sup. Mesenteric Artery



The abdominal part of the gut



- After elongation, it is now formed of:

a. **Proximal fusiform dilatation** (= future stomach).

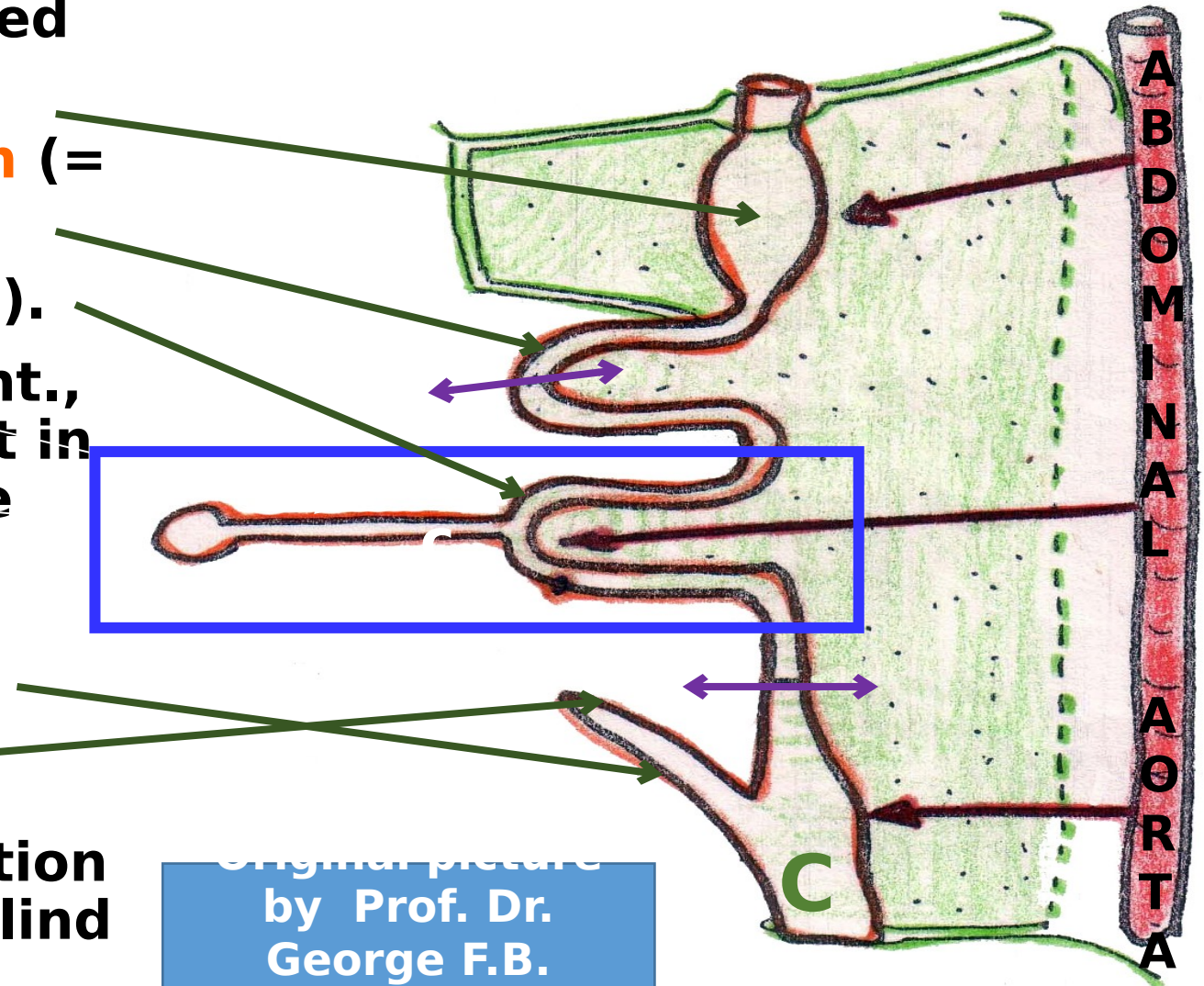
b. **Duodenal loop** (convex ant.).

c. **Midgut loop** (also convex ant., with the vitello-intestinal duct in its middle connecting it to the definitive yolk sac).

d. **Hindgut** with the **cloaca**:

i. Closed by the cloacal membrane.

ii. Sending a forward projection called **Allantois**, the distal blind end of which (reaching the umbilical cord) is called **Urachus**.

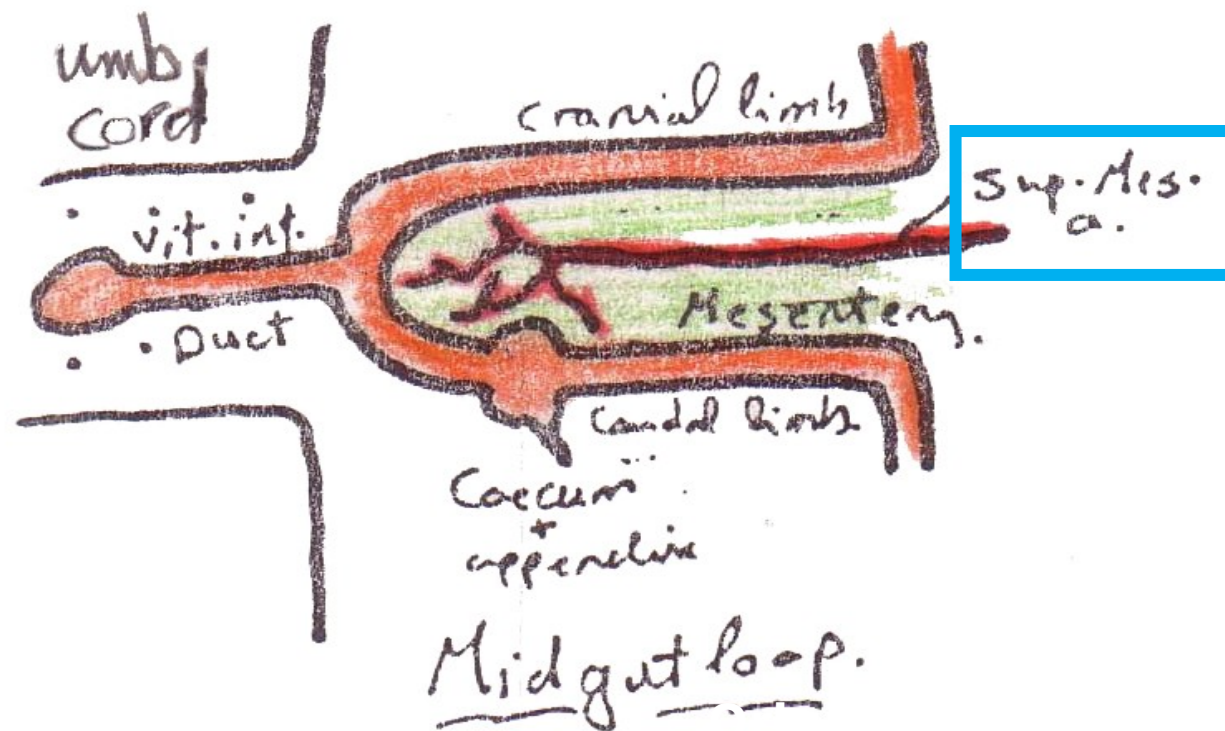


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The primitive midgut loop

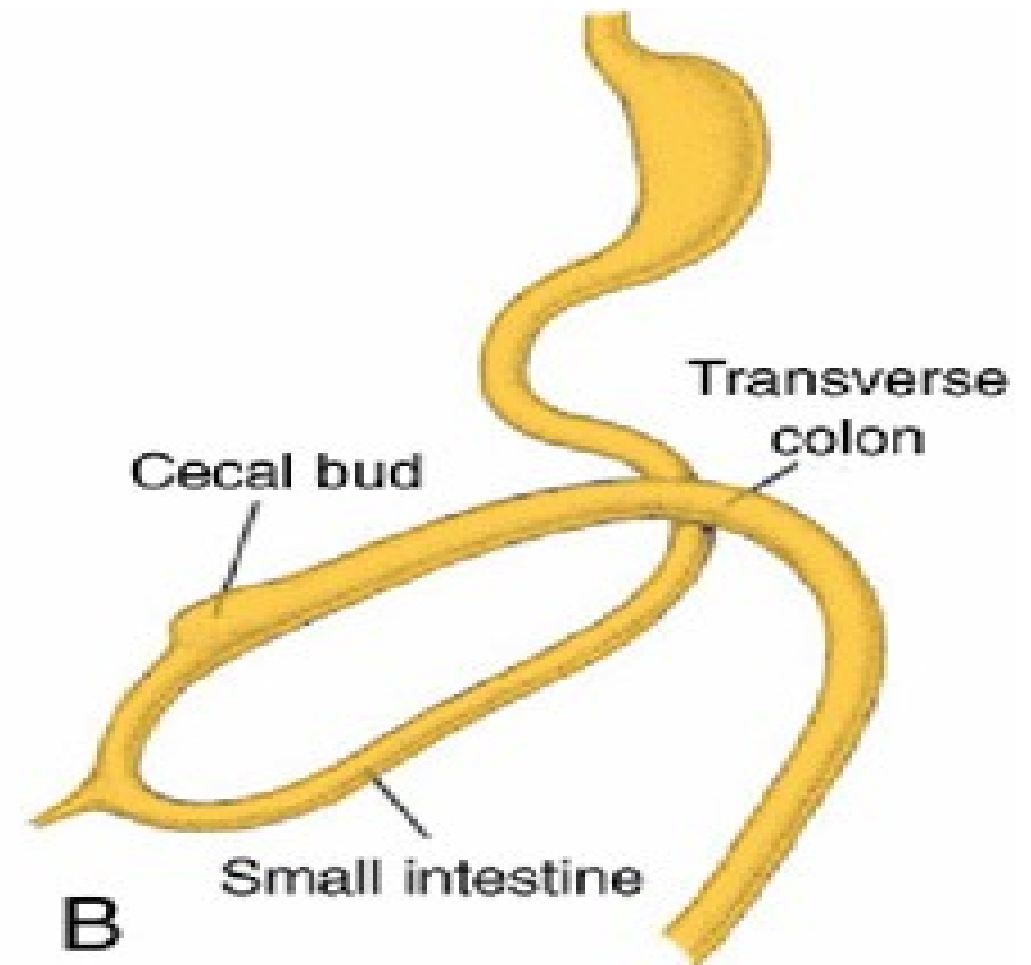
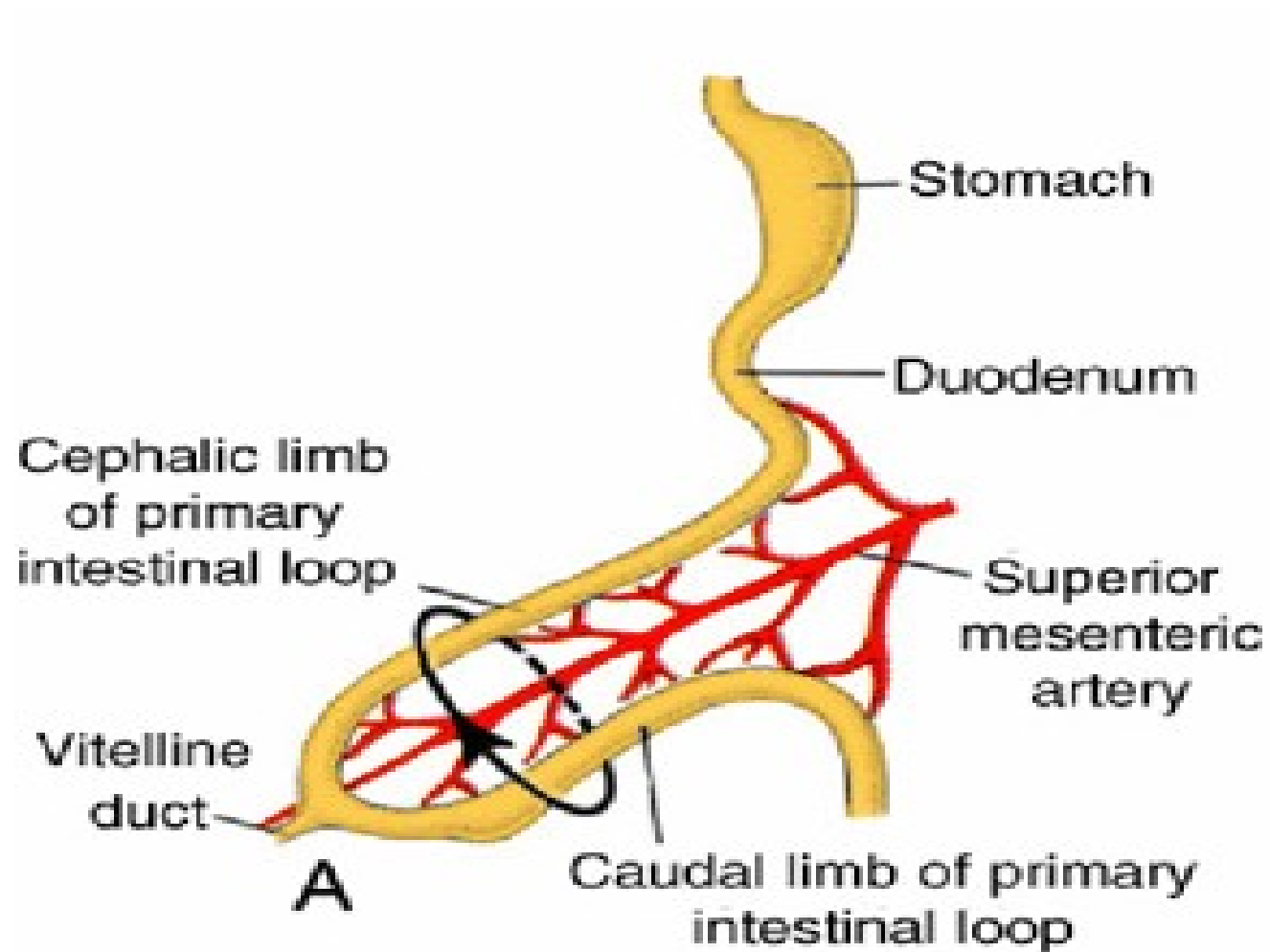


- The midgut loop is connected to the post. abdominal wall by a **dorsal mesentery** bet. the 2 layers of which passes the **SMA**, which also represents the **axis** of the midgut loop.



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What happens ?



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1- Physiological umbilical hernia

a. When ?: 6th week of intra-uterine life.

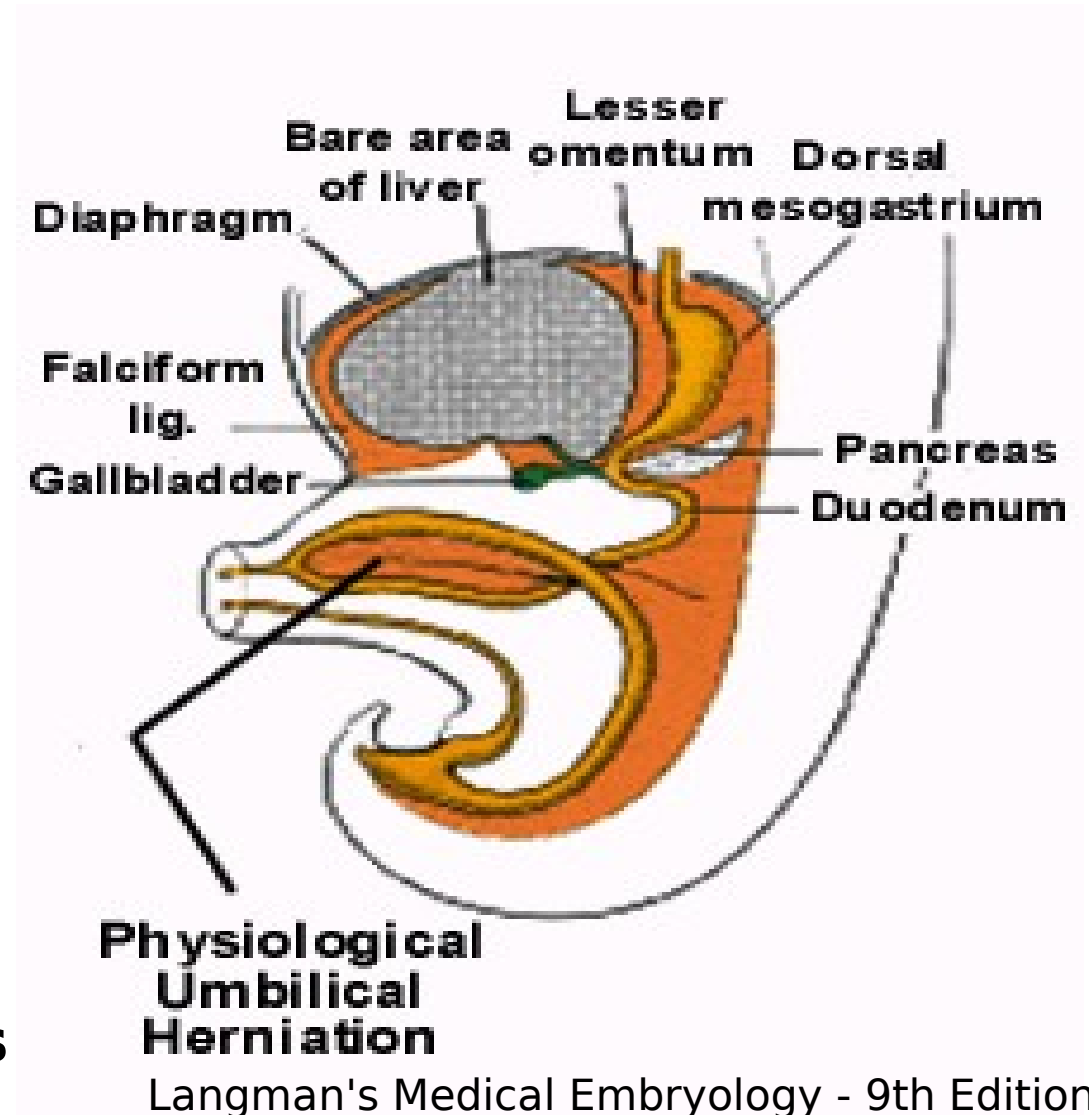
b. Where?: In the umbilical cord (only space left) for a month.

b. Why ?:

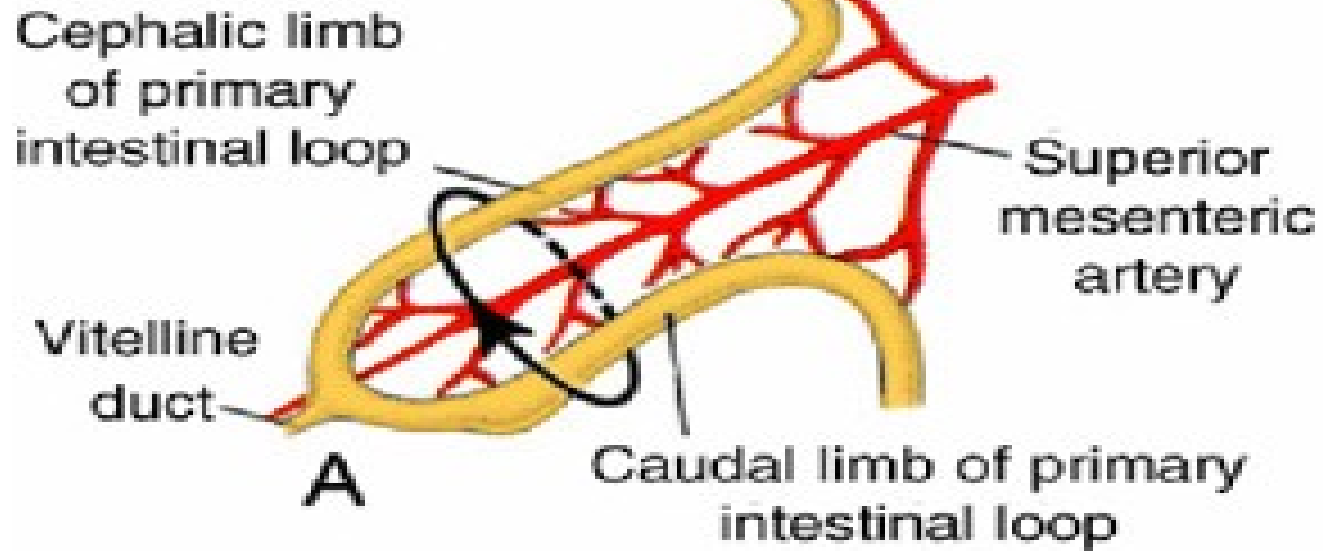
- i. Relatively small abdominal cavity.
- ii. Enlarged liver
- iii. Elongation & coiling of the loop.

c. How ?:

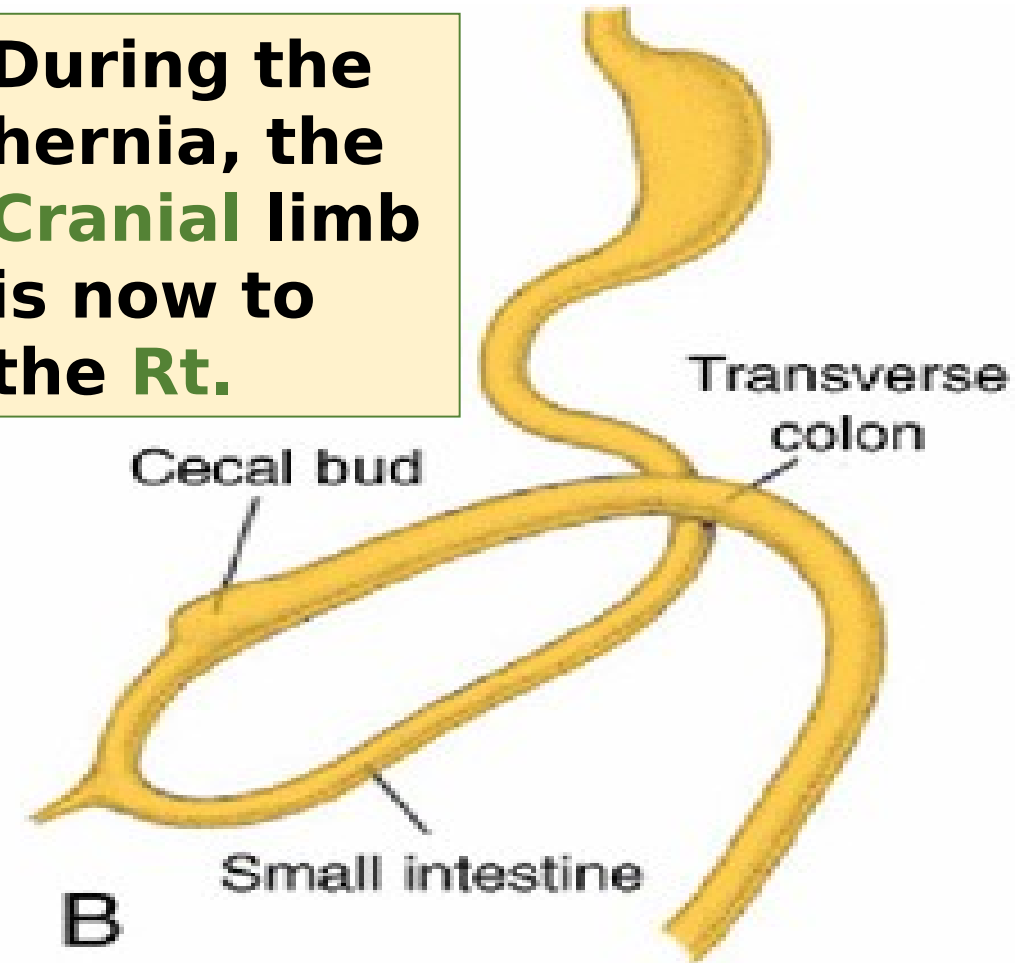
- i. The midgut loop **rotates 90° anticlockwise** around the SMA as an axis.
- ii. The **cranial** limb, as a result, becomes **directed to the Rt.**



The midgut loop rotates 90° anticlockwise around the **SMA** as an axis.

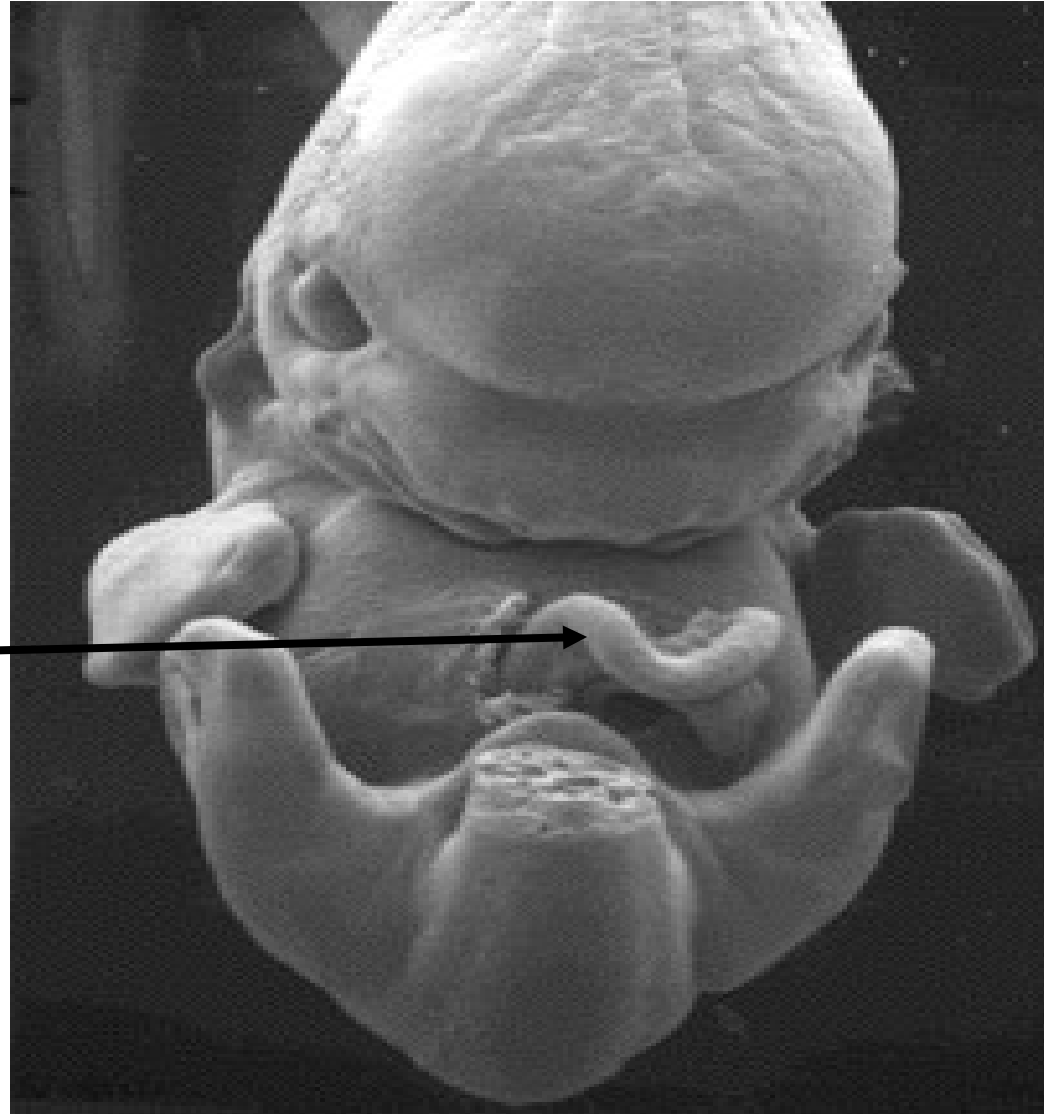


During the hernia, the **Cranial** limb is now to the **Rt.**



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**During the
hernia, the
Cranial limb
is now to
the Rt.**



2- Reduction of that physiological hernia

a. When?: 10th week of intra-uterine life (after a month from the hernia).

b. Where?: Back to the fetal abdominal cavity.

c. Why?:

i. Abdominal cavity becomes relatively wider.

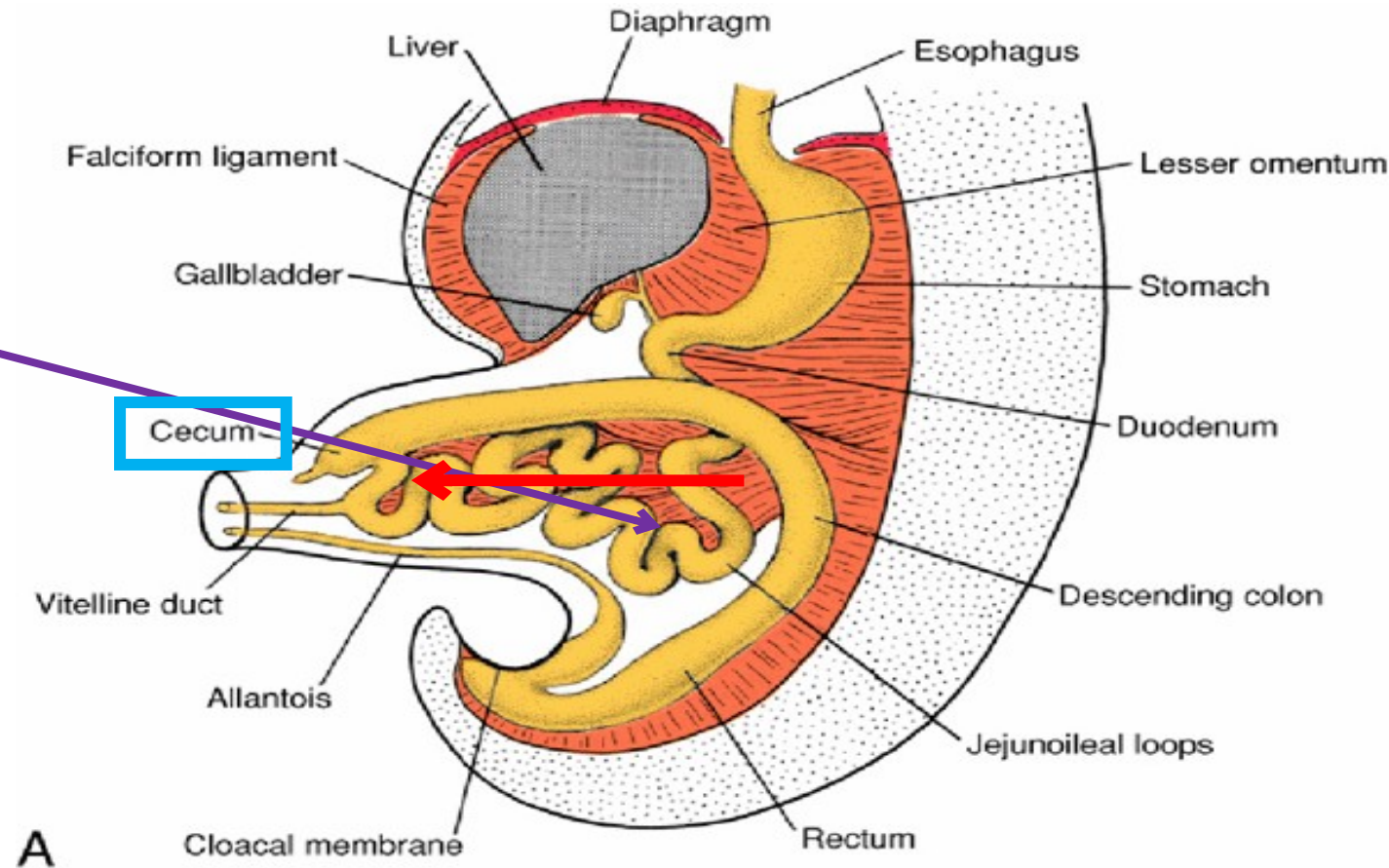
ii. Liver becomes relatively smaller.

iii. The fibro-muscular band around SMA contracts.

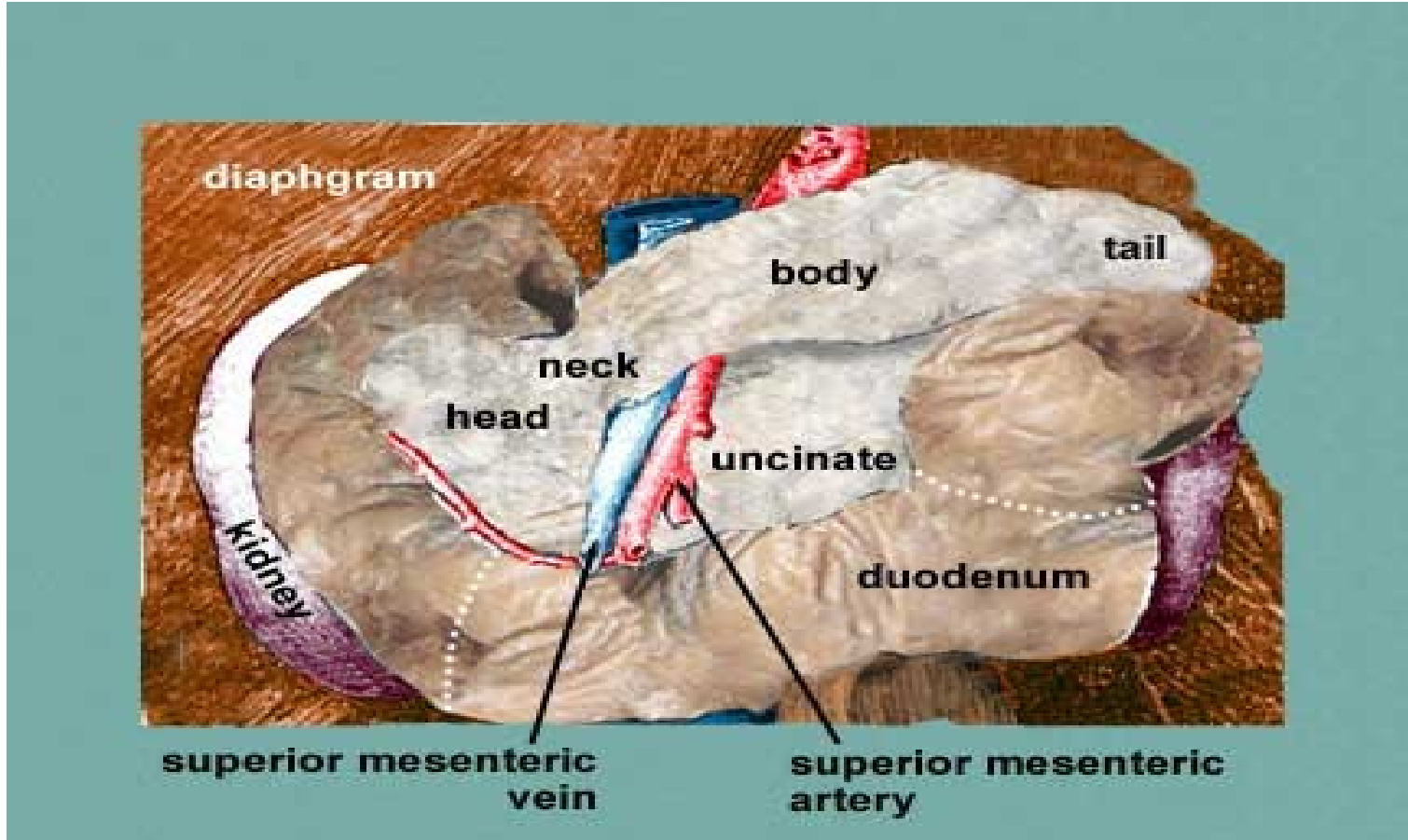
iv. The longitudinal muscle layer develops.

d. How?:

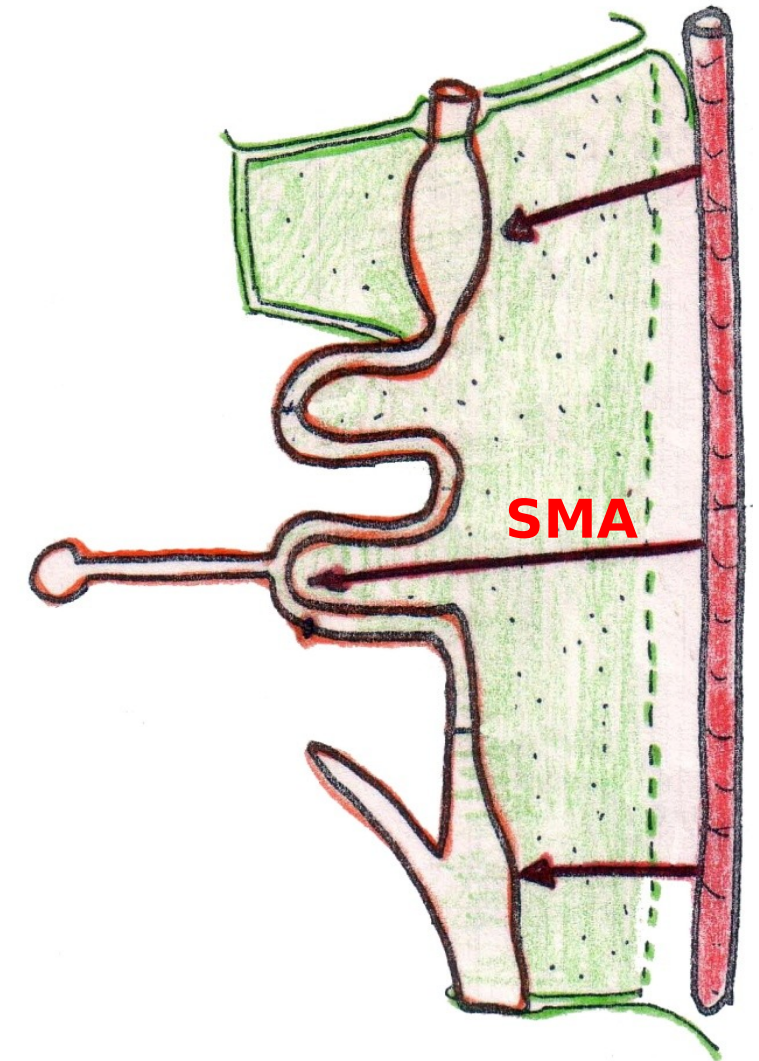
- i. Further 180° anticlockwise rotation occurs during reduction (i.e. total of 270° anticlockwise rotation).
- ii. The **cranial limb** is the **first** structure to be re-included & occupied the **Lt.** side of the fetal abdomen (opposite to the liver site), giving rise to the rest of duodenum, all jejunum & much of the ileum
- iii. **Followed by the SMA.** This explains why the SMA crosses ant. to the 3rd part of duodenum ??.
- iv. The **caecum** is the **last** structure reduced & at first is subhepatic.



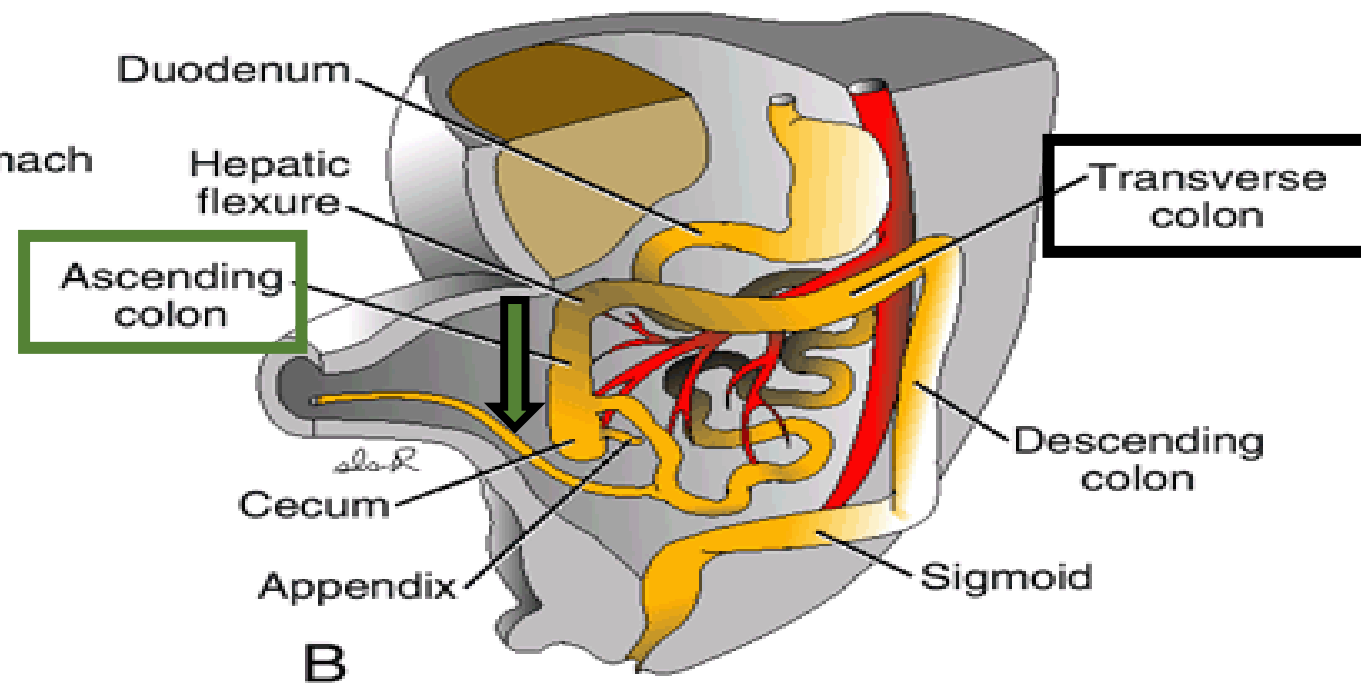
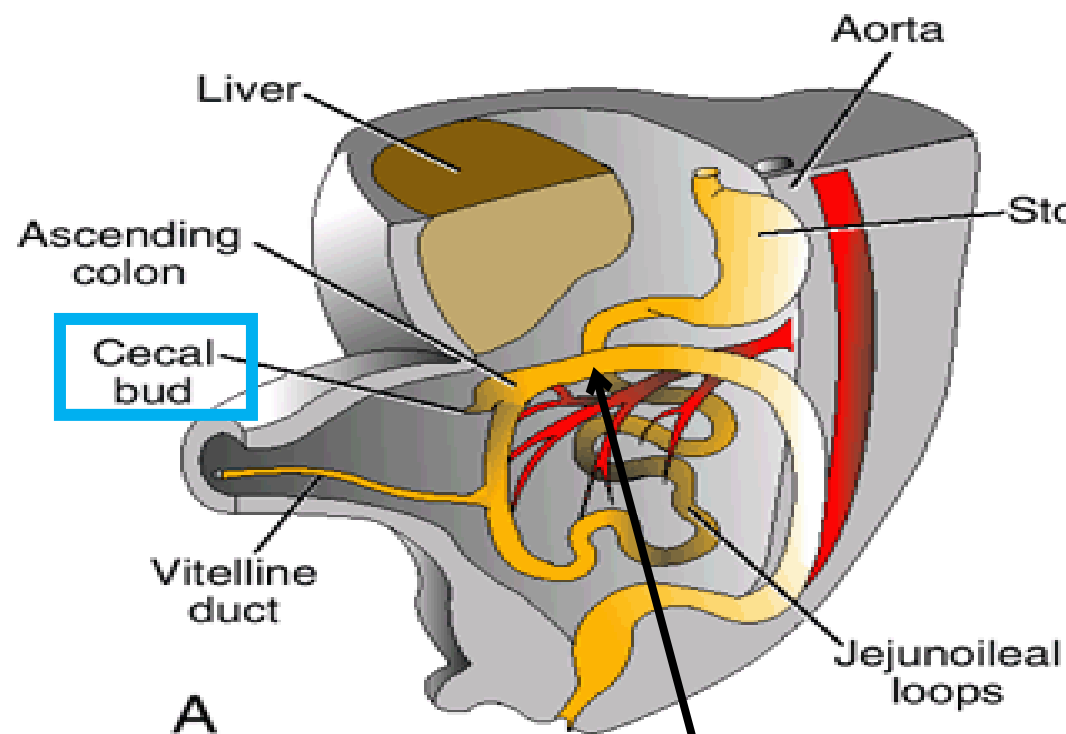
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SMA crosses ant. to the 3rd part of duodenum, although it was post. to midgut.

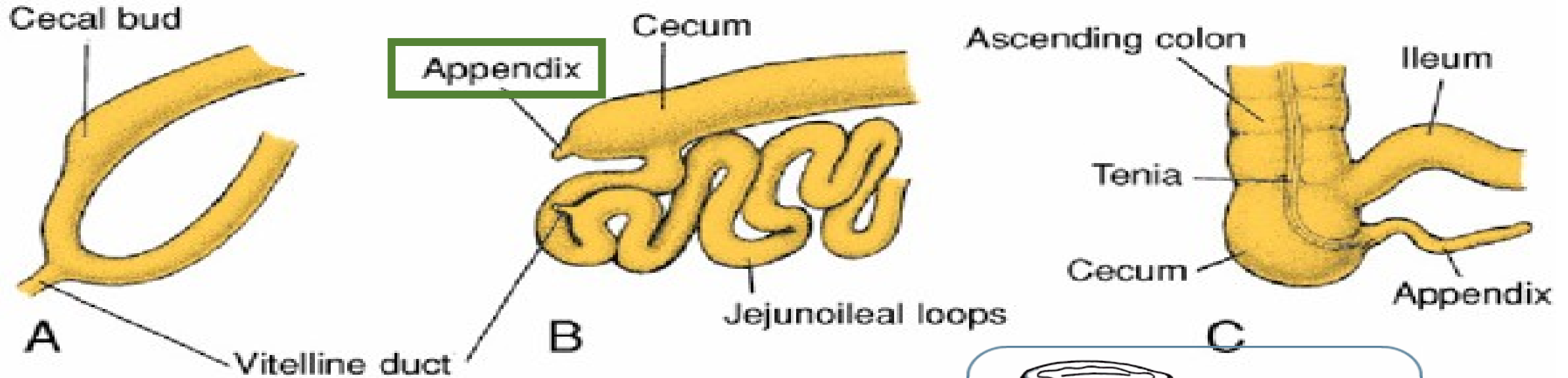


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3- The caecum is at first subhepatic:

- The transverse colon (rest of the caudal limb) lies transversely below the liver.
- The caecum later on descends to the Rt. iliac fossa, thus elongating & creating the ascending colon.



4- Appendix:

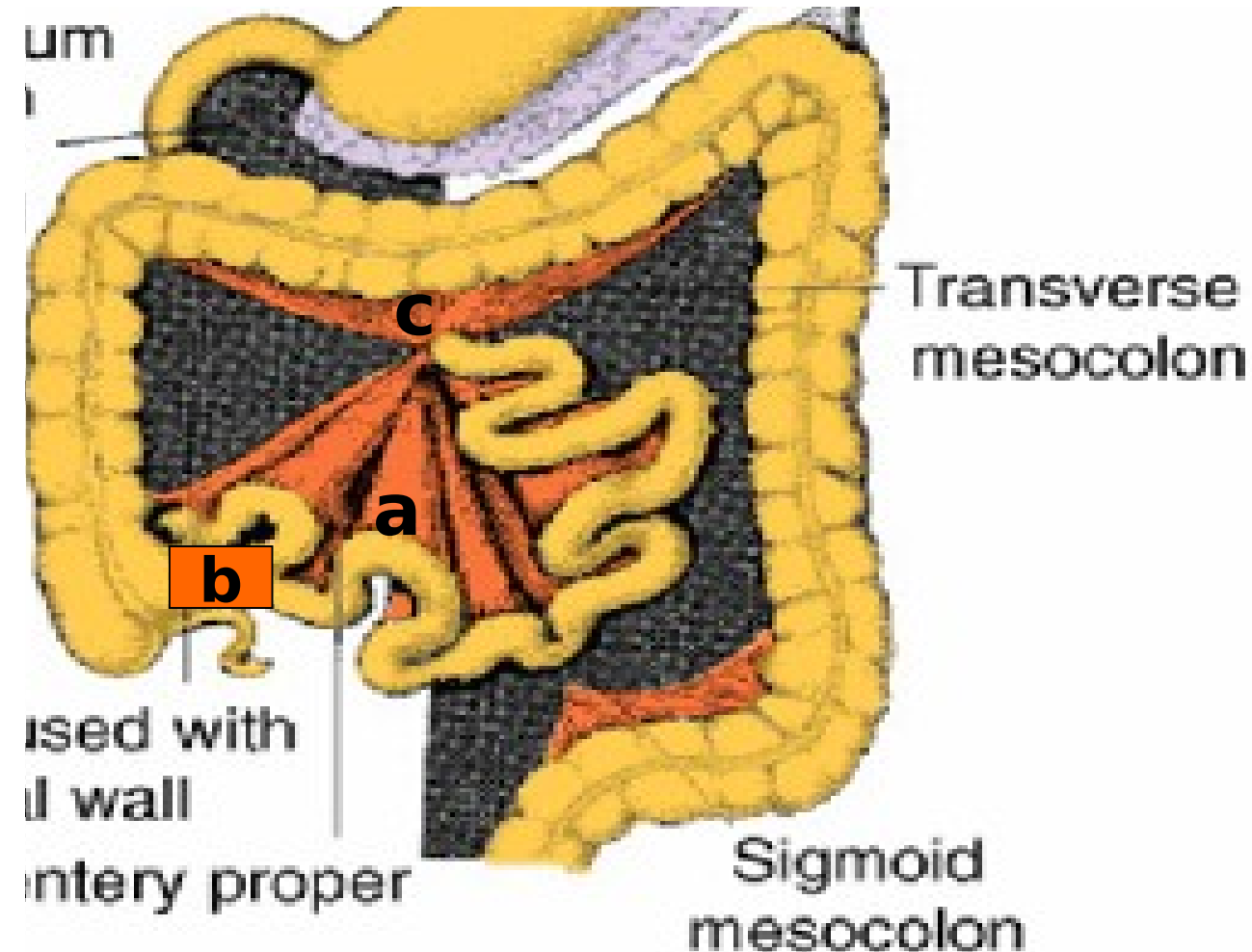
- Arises at first from the apex of caecum (**apical appendix**) & then becomes **retro-caecal** in 75% of cases.
- Other positions include pelvic, subcaecal, preileal & postileal.



5- What about the dorsal mesentry ?

- The dorsal mesentry is absorbed only in the region of ascending colon, while in other parts it remains giving rise to:

- a. Mesentry of small intestine.
- b. Mesoappendix.
- c. Transverse mesocolon.



Lecture Quiz



Rotation of intestinal loops of midgut:

- a. Is 270° anticlockwise.
- b. Is 270° clockwise.
- c. Places the Rt. vagus anterior to the stomach.
- d. Places the Lt. vagus posterior to the stomach.
- e. Occurs around the axis of inferior

Lecture Quiz **Answer**



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IT'S OBVIOUS



Time for Students' Questions

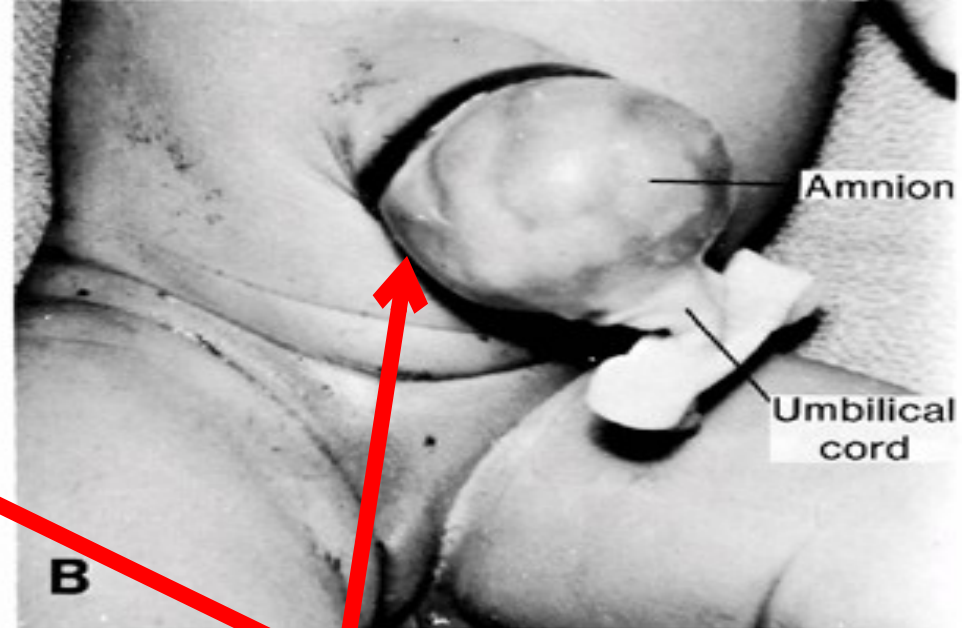
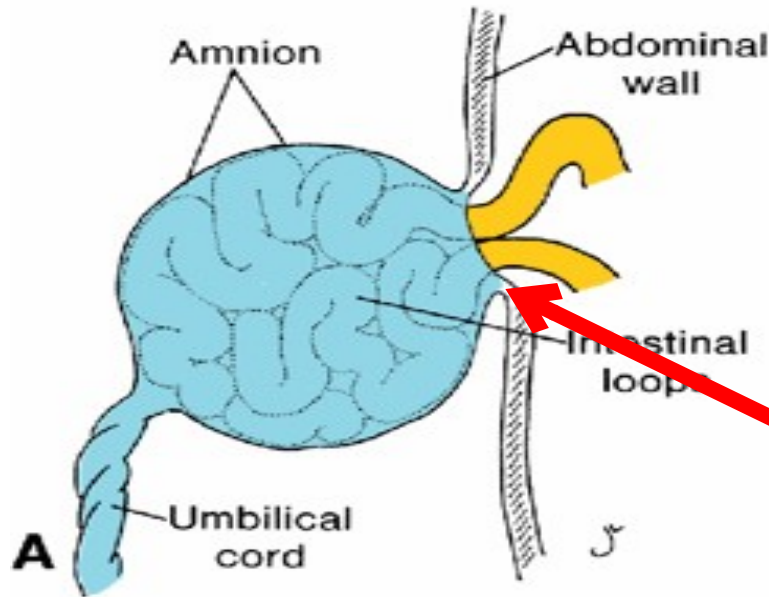


Anomalies of midgut



- 1. Atresia or stenosis**
- 2. Persistent mesentery**
- 3. Sub-hepatic caecum**
- 4. Omphalocele (Congenital umbilical hernia).**
- 5. Gastroschisis**
- 6. Anomalies of vitello-intestinal duct**
- 7. Rotation anomalies**

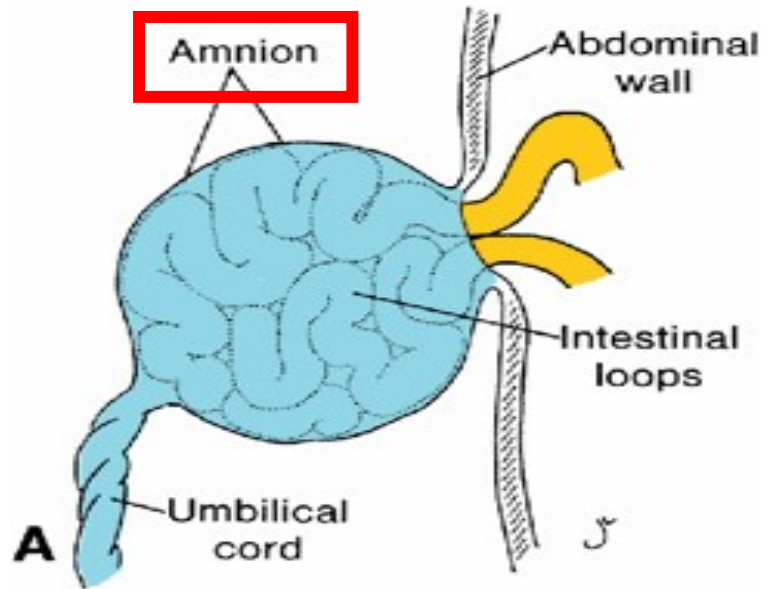
4.



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- Is a herniation of abdominal viscera **through an enlarged umbilical ring**.
- The origin of the defect is a failure of the bowel to return to the body cavity from its physiological herniation during the 6th to 10th weeks.

4.

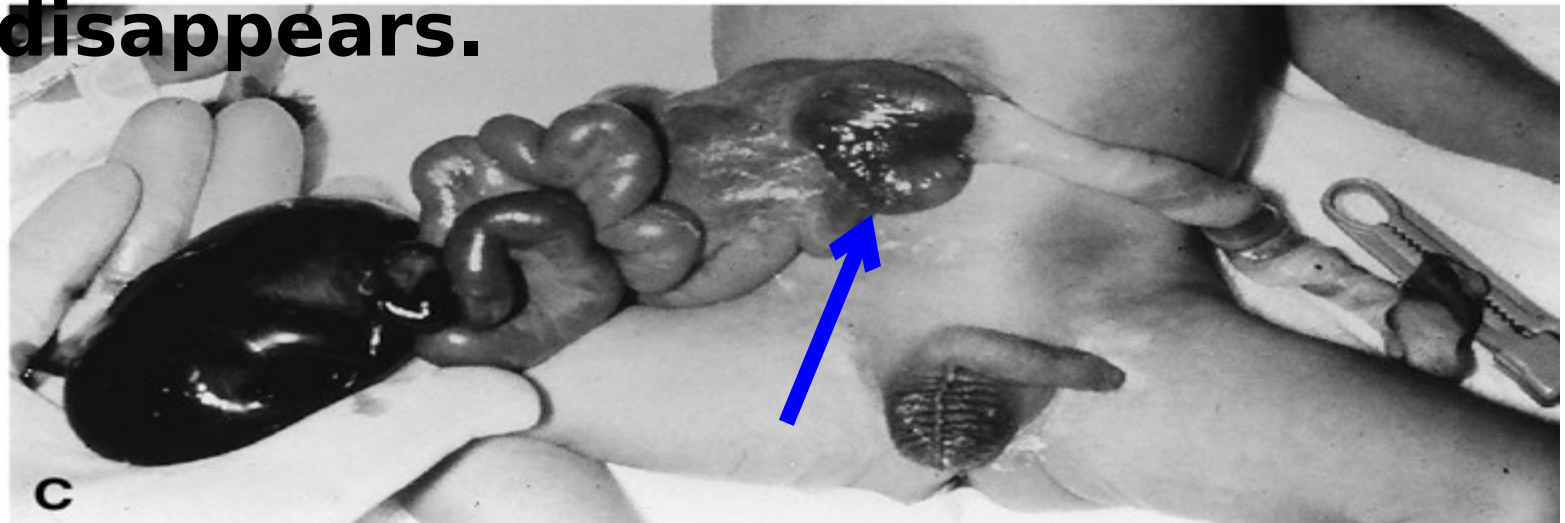


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- It occurs in **2.5/10,000** births
- The viscera (which may include liver, small and large intestines, stomach, spleen, or gallbladder) **are covered by amnion**.
- Is associated with **a high rate of mortality (25%) and severe malformations**, such as cardiac anomalies (50%) and neural tube defects (40%).
- **Approximately half of live-born infants with omphalocele have chromosomal abnormalities.**

5. Gastroschisis

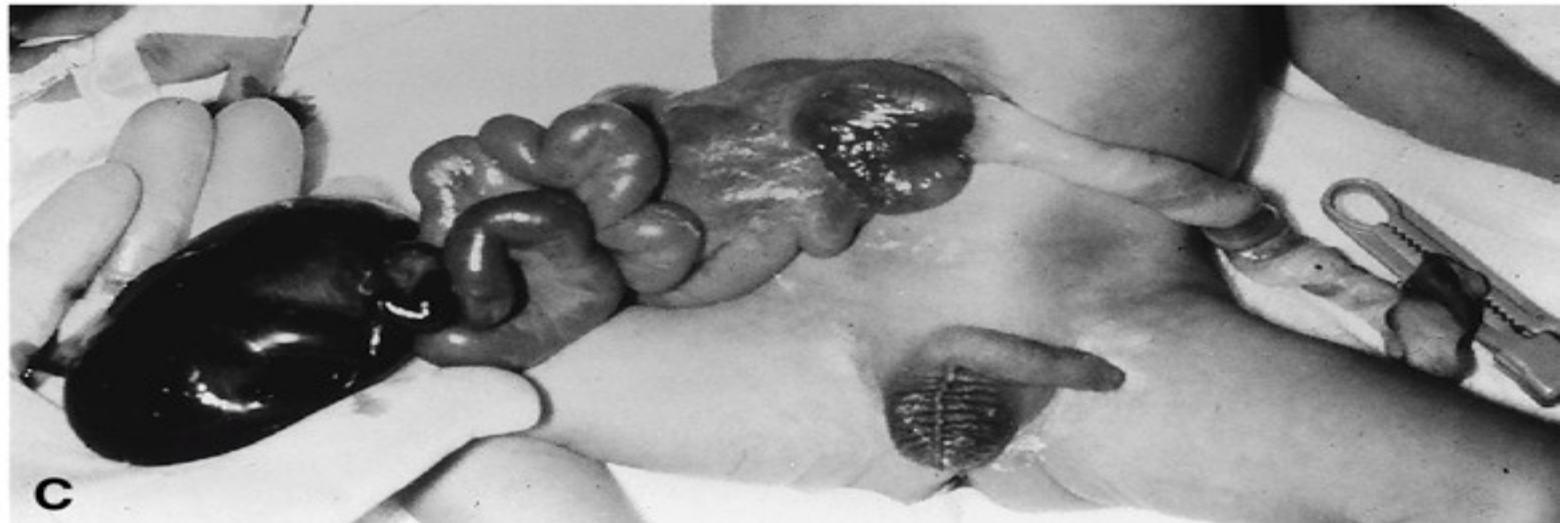
- Is a herniation of abdominal contents through the body wall directly into the amniotic cavity.
- It occurs **lateral to the umbilicus usually on the right**, through a region weakened by regression of the right umbilical vein, which normally disappears.



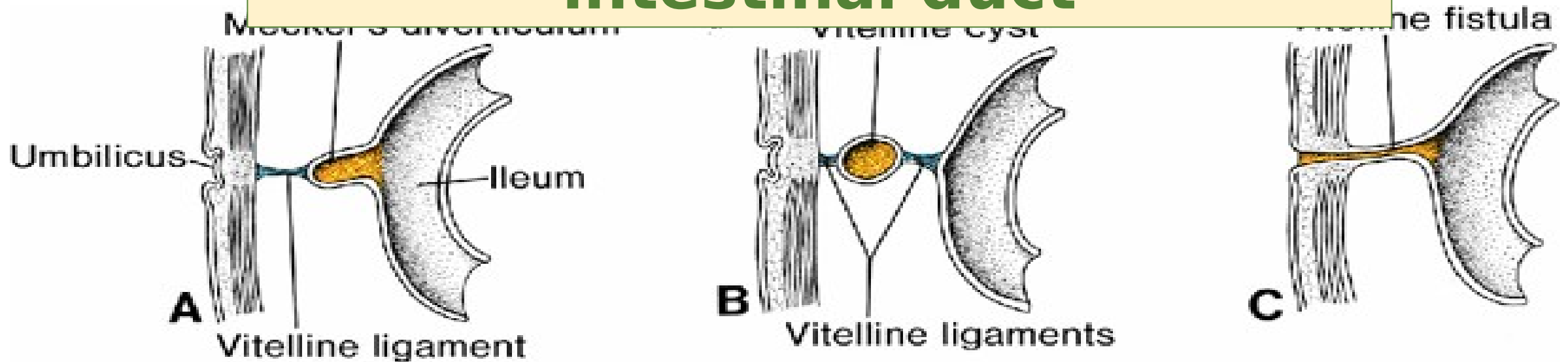
5. Gastroschisis



- It occurs in **1/10,000** births (but is increasing in frequency, especially among young women; this increase may be related to cocaine use).
- Viscera are **NOT** covered by peritoneum or amnion → the bowel may be damaged by exposure to amniotic fluid.
- Unlike omphalocele, gastroschisis is **NOT** associated with chromosome abnormalities **or** other severe defects → **the survival rate is excellent**.



6. Anomalies of vitello-intestinal duct



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• Normally, the vitello-intestinal duct disappears but if:

A- Its proximal end persists → Meckel's diverticulum.**

A'- Its distal end persists → Vitelline ligament.

B- Its middle part persists → Vitelline cyst.

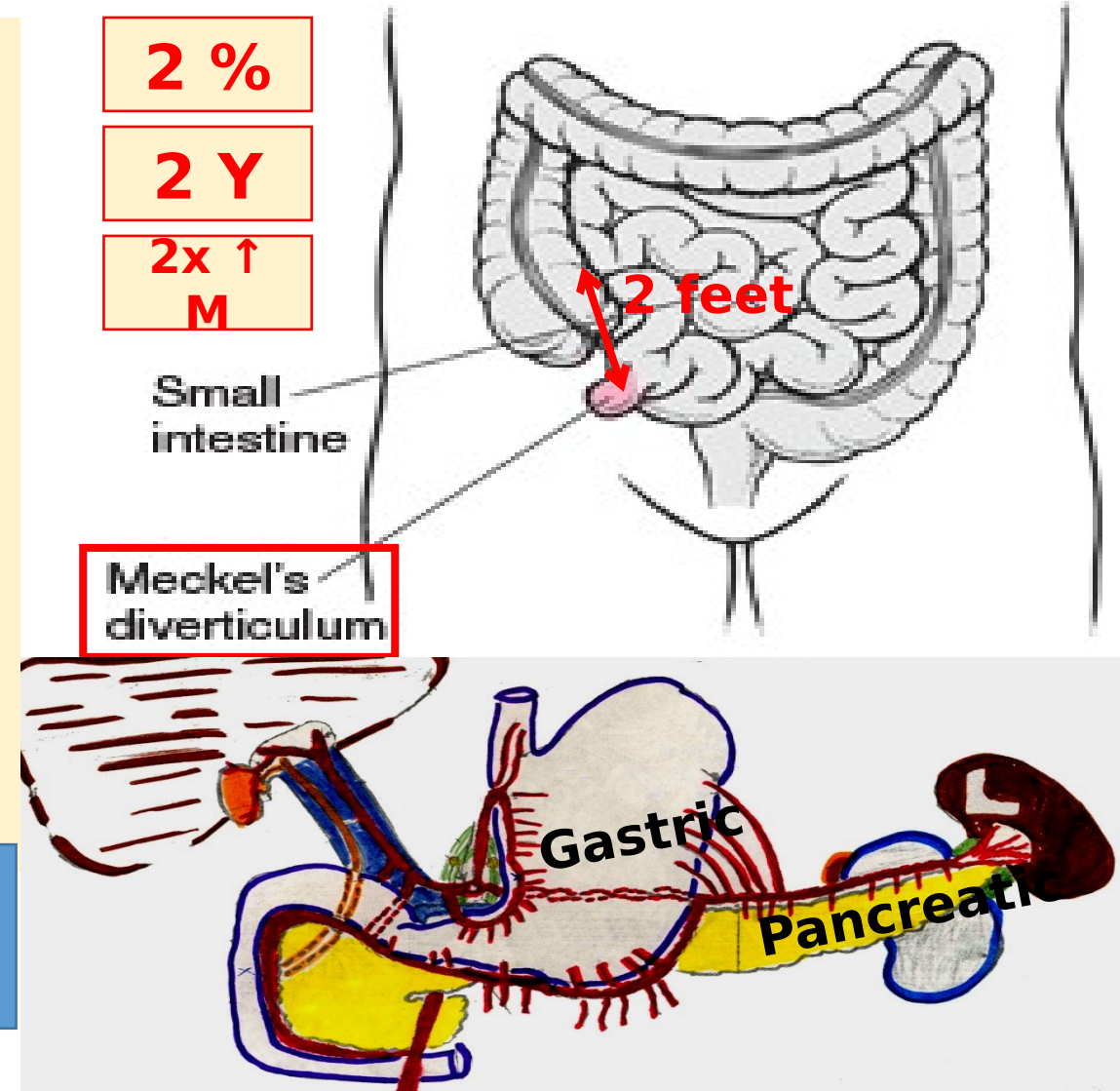
C- All of it remains patent → Vitelline fistula.

****MECKEL'S DIVERTICULUM**

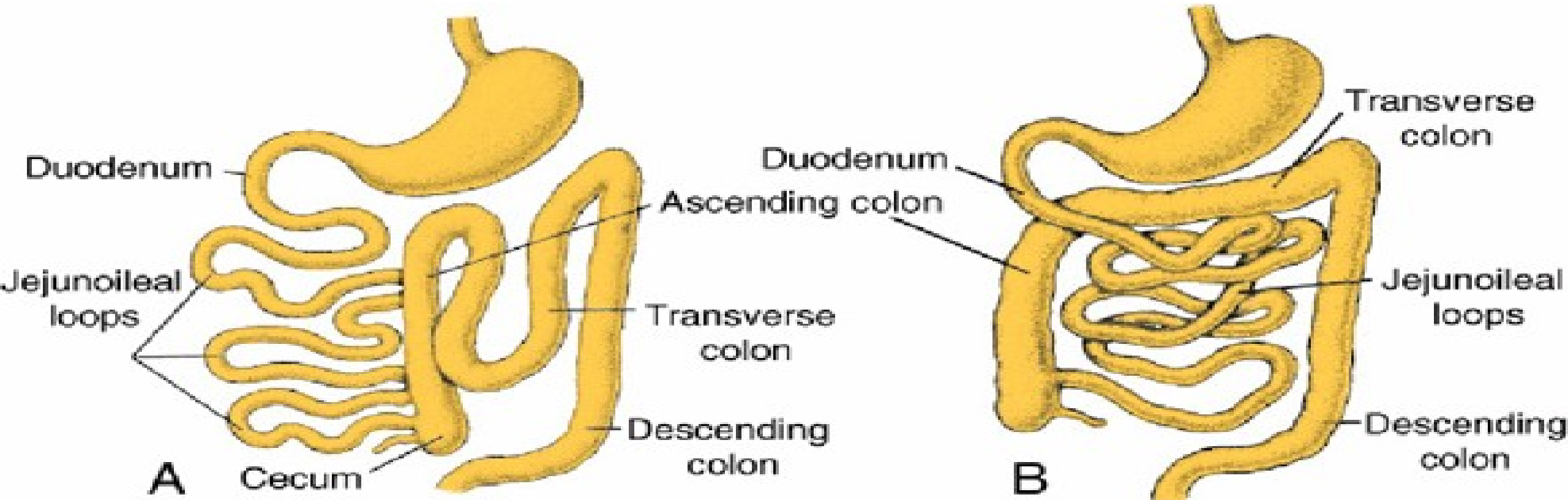
A memory aid is the rule of 2's:

- **2%** (of the population).
- **2 feet** (from the ileo-cecal valve).
- **2 inches** (in length).
- **2%** are symptomatic.
- there are **2** types of common ectopic tissue (**gastric** and **pancreatic**).
- the most common age at clinical presentation is **2 years**.
- Males are **2 times** as likely to be affected.

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7. Rotation Anomalies



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A- Mal-rotation for only 90°
B- Reversed rotation

Lecture Quiz



During a surgery to relieve small bowel obstruction in a 3-year-old boy, an incidental abdominal cyst is discovered and removed. The cyst is connected by a fibrous band to the ileum and the umbilicus. Which of the following conditions is caused by the same embryologic defect responsible for this patient's abdominal cyst?

- A. Intestinal atresia.**
- B. Meckel's diverticulum.**
- C. Imperforate anus.**
- D. Omphalocele.**

Lecture Quiz **Answer**



During a surgery to relieve small bowel obstruction in a 3-year-old boy, an incidental abdominal cyst is discovered and removed. The cyst is connected by a fibrous band to the ileum and the umbilicus. Which of the following conditions is caused by the same embryologic defect responsible for this patient's abdominal cyst?

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- C. Imperforate anus.**
- D. Omphalocele.**

SUGGESTED TEXTBOOKS



Langman's Medical Embryology, 9th edition, Chapter 13 , p. 304-313.

THANK YOU

